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(54) SANDHEAT MODULE

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ABSTRACT

A concrete floor having a heat transfer pipe embedded therein for circulation of heating or cooling fluid, as well as a method of construction thereof. The method comprises the steps of laying a transportable base section with a pipe secured in the desired configuration to the surface thereof, in the area where the concrete floor is to be constructed. The base section and pipe are covered with a layer of heat conductive granular material such as sand, and cement is then poured over the granular material to the desired floor level. The base section with the pipe secured thereto may be preassembled at a location away from the building site. A concrete floor constructed according to the method of the present invention, since the piping is embedded in sand, enables freer movement of piping during expansion and contraction, and significantly reduces the incidence of material fatigue.

BACKGROUND OF THE INVENTION

The present invention relates to a concrete floor having a pipe embedded therein for circulation of heating or cooling fluid, as well as a method of construction thereof.

Previously, conducting heat or cold to concrete floors in order to heat or chill such floors has been accomplished by in situ alignment of steel, copper or plastic piping on a sub-floor surface, or on deck forms, prior to the pouring of concrete. Such a method poses many installation problems. For example, handling of piping material on the building site is awkward. It is hard to maintain proper alignment or positioning of piping, this problem being aggravated on grade installations. Moreover the piping may have a tendency to float during the pouring of concrete. Handling of the piping for layout in installation also requires a significant amount of labour, thus adding to the construction costs.

In some instances, the piping is secured directly to the sub-floor surface to at least maintain proper alignment of piping during the pouring of the concrete. On-site layout and measuring for the fastening points for piping, and then the fastening of the piping in position again is awkward and time consuming.

A solution for some of these problems has been proposed in Musgrave et al Canadian Patent No. 261,219 issued June 1, 1926 in which pipes to be embedded in concrete walls are temporarily secured to moulds used in the pouring of the concrete for the walls, and then, when the concrete has set, releasing the moulds from the pipes.

Crittall et al Canadian Patent No. 261,221 also issued June 1, 1926, describes and illustrates a concrete building structure having heating/cooling pipes therein, the pipes being secured to metal lathing or netting stretched between reinforced concrete uprights and crossbars, and this whole sub-structure then being covered with concrete. In Musgrave Canadian Patent No. 150,026 issued August 19, 1913, a method of heating and cooling a building is described in which coils of pipes are fitted against a non-conductor of heat, and a heat conducting material in plastic or semi-plastic material (presumably unset plaster or concrete) is then laid on the pipes, thereby embedding the pipes in that heat conducting material.

A more recent proposal is described in U.S. Patent No. 4,212,348 of Kobayashi issued July 15, 1980, in which a radiating floor board for a building has a metal surface plate behind which are situated metallic tubes for circulation of hot water beneath the plate, the metallic tubes being completely surrounded by a heat insulating material such as foam.

It is an object of the present invention to eliminate piping alignment and handling problems on sites where concrete floors having heating or cooling pipes embedded therein are being constructed. It is a further object of the invention to reduce or eliminate the tendency of such piping to float during the pouring of concrete and to reduce the incidence of material fatigue brought about by the expansion and contraction of such pipes when the concrete has set. Yet a further object of the present invention is to provide a uniform method of securing piping for such

constructions, and to significantly reduce the man hours required to perform the task of installing piping for concrete floors.

SUMMARY OF THE INVENTION

According to the present invention there is provided a novel type of a concrete floor having a heat transfer pipe embedded therein for circulation of heating or cooling fluid, as well as a method of construction thereof. The method comprises the steps of laying a transportable base section with a pipe secured in the desired configuration to the surface thereof, in the area where the concrete floor is to be constructed. The base section and pipe are covered with a layer of heat conductive granular material such as sand, and cement is then poured over the granular material to the desired floor level. The base section with the pipe secured thereto may be preassembled at a location away from the building site.

Since the base to which the pipe is secured need not be prepared in situ, but may be made up to a uniform layout at a factory, and then delivered to the building site, the invention frees the construction tradesmen from the tasks of layout for piping runs, layout and setting of piping clips and the like, thereby reducing the on-site labour significantly. Embedding the base section with pipes secured thereto in sand provides for freer movement of the pipe during expansion and contraction, and reduces significantly the occurence of material fatigue as compared to prior art constructions. Moreover, the base section, since it may be secured to the floor or sub-surface, additionally lessens heat loss over prior art installations where the heat transfer pipes were secured directly to

the flooring or sub-surface.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon referring to the drawings in which:

Figure 1 is a perspective view of a base section to which pipe has been secured in accordance with the present invention;

Figure 2 is an enlarged fragmentary plan view of a portion of the base section and pipe of Figure 1;

Figure 3 is an elevation section view taken along line III-III of Figure 2;

Figure 4 is a schematic plan view of a grouping of base sections according to Figure 1 in position for the construction of a concrete floor thereabove; and,

Figure 5 is a section view of a part of a concrete floor made in accordance with the present invention. While the invention will be described in connection with an example embodiment, it will be understood that it is not intended to limit the invention to such embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE DRAWINGS

Turning to Figure 1 there is shown a base section 2 to which a pipe 4 is secured in serpentine fashion. Base section 2 may be of hardboard or any other appropriate rigid flat material.

Hardboard is suitable because of its low heat conductivity characteristics. Pipe 4 is for example copper, polybutylene or the like. As can be seen best in Figures 2 and 3, pipe 4 is secured to base 2 by means of ties 6 spaced at appropriate locations along the length of pipe 4. Ties 6 may be of any appropriate construction. Bundling straps, of a construction somewhat similar to those illustrated in U.S. Patent No. 3,186,047 of Schwester et al issued June 1, 1965, have been found appropriate. Such ties comprise a self-clinching strap 8, at one end of which is secured an eyelet 10 which securely receives the other end of strap 8, locking that end against releasing movement.

As can be seen in Figures 2 and 3, appropriate holes 12 are drilled in either side of the pipe location on base 2, through which holes the straps 8 pass to circumscribe the corresponding portion of pipe 4 and base section 2 and hold them in secure abutting relationship.

It is preferred for construction of concrete floors according to the present invention that pipe 4 be arranged for uniform heating or cooling on base section 2 as shown in Figures 1 and 4. Pipe ends 18, for each base section 2, are preferably situated near an edge of that base section so that, as shown in Figure 4, a plurality of base sections may be juxtaposed and the ends of pipes 18 joined to permit continuous passage of fluid through the entire length of pipe as illustrated, or to facilitate connection of one end of the pipe on one base section 2 or a group thereof to a fluid inlet 20, and the other end to a fluid outlet 22.

Turning to Figure 5 there is shown a cross-sectional view of a section of a concrete floor made according to the present invention. To a sub-floor 30, base section 2, to which pipe 4 has been previously secured in the manner hereinbefore described, is secured with nails 32 or staples (not shown). The base section 2 and pipe 4 are covered with a layer of sand 34 over which vapor barrier 36 (polyethelene or the like) is laid. Concrete layer 38 is then poured to the desired level of the concrete flooring, and allowed to set.

Thus, according to the present invention, base section 2 with a pipe appropriately positioned thereon may be made up under factory conditions, away from the building site, and then delivered to the building site to be incorporated in the construction of the concrete floor. The use of such a base enables a very regular and uniform pipe orientation on the base to be achieved, since appropriate holes for ties may be accurately located and drilled on the base sections, ties inserted in the holes, but not closed, and pipe 4 then rolled out in the appropriate orientation on the surface of base section 2 after which the ties 6 are closed to secure pipe 4 to the base section. In accordance with the present method, the base section 2 becomes a permanent part of the installation. It serves the additional function of lessening heat loss to sub-floor 30.

It will be understood that when the method of the present invention is carried out, construction of heating systems of the type in question is improved by avoiding the need to lay out and measure the fastening points for piping at the site (this having already been

done in the factory where base section 2 with pipe 4 secured thereto has been previously made up) avoiding the need to secure the pipe in proper orientation in site (again this having already been accomplished at the factory). Moreover, the present invention, by enabling the pipes to be embedded in a sand layer, greatly reduces the occurrence of material fatigue of the pipes and surrounding flooring material over prior art devices. Applicant's invention reduces significantly the on-site labour costs required for installation of such flooring, it being estimated that approximately ten man hours are required for installation of one thousand square feet according to the present invention, whereas prior art systems require approximately thirty-one man hours for a similar installation area.

Thus it is apparent that there has been provided in accordance with the invention a novel type of concrete floor having a heating or cooling pipe embedded therein, as well as a method of construction thereof that fully satisfies the objects, aims and advantages set forth above. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and broad scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method of construction of a concrete floor having a heat transfer pipe embedded therein for circulation of heating or cooling fluid, the method comprising the sequential steps of:

(a) laying a transportable base section, with the pipe secured in the desired configuration to the surface thereof, in the area where the concrete floor is to be constructed;

(b) covering the base section and pipe with a layer of heat conductive granular material;

(c) pouring concrete over the granular material to the desired floor level; and

(d) allowing the concrete to set to form the concrete floor.

2. A method according to claim 1 comprising the further step of securing the base section to a sub-floor after this base section has been laid in place and before it is covered with granular material.

3. A method according to claim 2 wherein the conductive granular material with which the base and pipe are covered is sand.

4. The method according to claim 1, 2 or 3 comprising the further step of securing the pipe in the desired configuration to the surface of the transportable base section.

5. The method according to claim 1 wherein the layer of heat conductive granular material is covered with a vapor barrier prior to the pouring of concrete.

6. A concrete floor having a heat transfer pipe embedded therein for circulation of heating or cooling fluid, the floor comprising a pipe for carrying the heating or cooling fluid secured in the desired configuration to the surface of a transportable base section by securing means, the base section and pipe being covered with a layer of sand, and the sand being covered with a layer of concrete to the desired floor level.

7. A floor according to claim 6 wherein the base section is a rigid flat piece of hardboard.

8. A floor according to claim 6 wherein the pipe is secured to the base section in a regular serpentine fashion to provide uniform heating or cooling across the surface area of the floor.

9. A floor according to claim 6 or 7 wherein the securing means comprise a plurality of self-clinching bundling straps, pairs of holes being drilled at appropriate locations in the base section to receive the straps to circumscribe the pipe and corresponding portions of the base section.

10. A floor according to claim 6 further provided with a vapor barrier between the sand layer and concrete layer.

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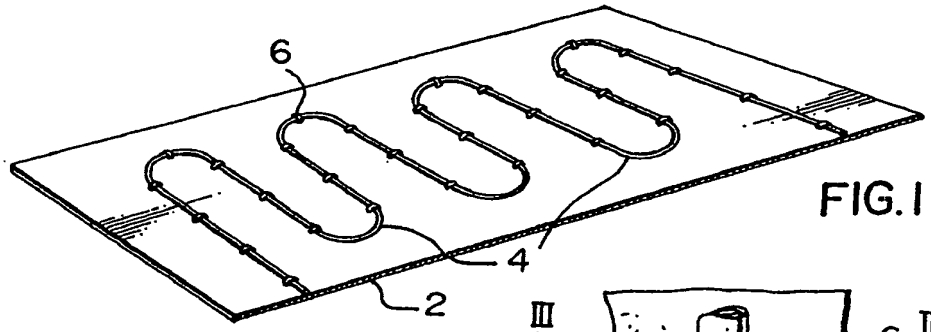

FIG. 1

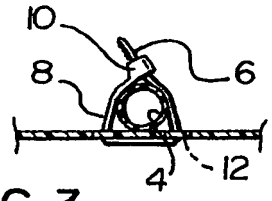

FIG. 3

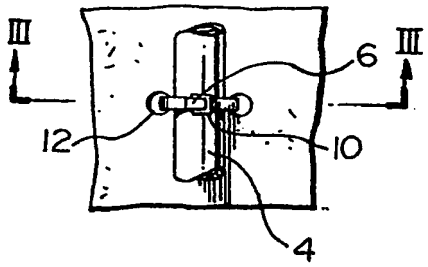

FIG. 2

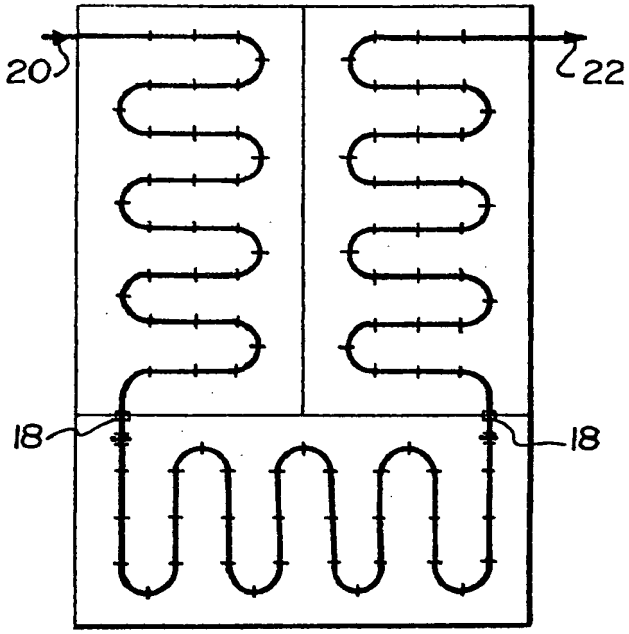

FIG. 4

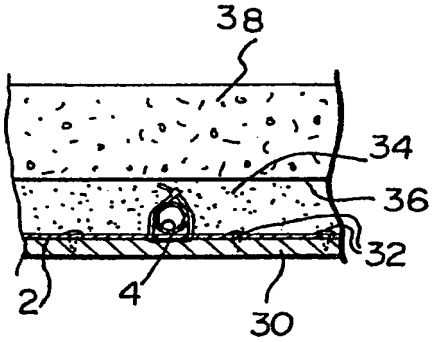

FIG. 5

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